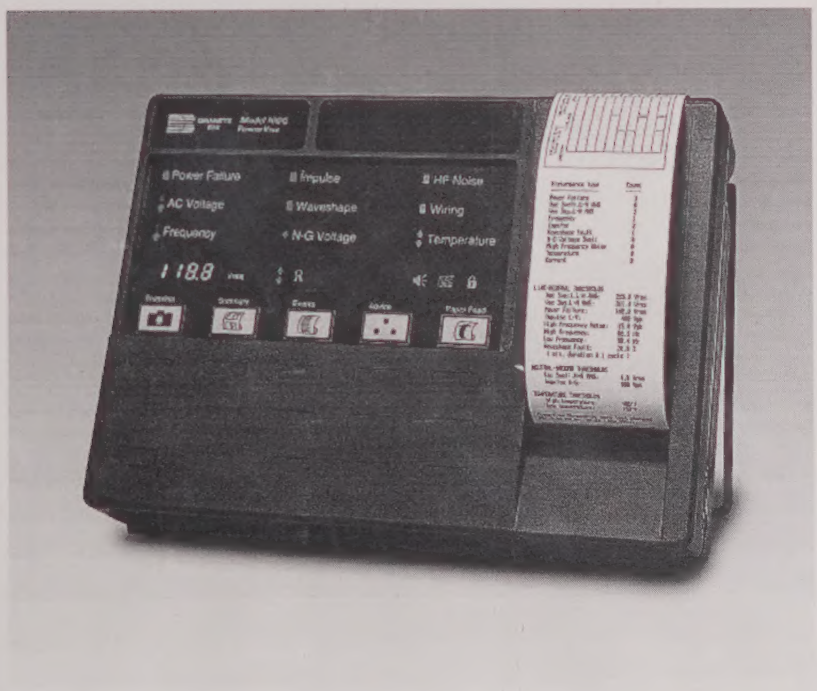
DRANETZ
BMI

100G PowerVisa®
User's Guide



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wilsonjones™

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100G PowerVisa®
User's Guide

WARNING

Death, serious injury, or fire hazard could result from improper connection of this instrument. Read and understand this manual before connecting this instrument. Follow all installation and operating instructions while using this instrument.

Connection of this instrument must be performed in compliance with the National Electrical Code (ANSI/NFPA 70-1996) of USA and any additional safety requirements applicable to your installation.

Installation, operation, and maintenance of this instrument must be performed by qualified personnel only. The National Electrical Code defines a qualified person as "one familiar with the construction and operation of the equipment and the hazards involved."

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Safety Summary

ADVERTENCIA

Una conexión incorrecta de este instrumento puede producir la muerte, lesiones graves y riesgo de incendio. Lea y entienda este manual antes de conectar. Observe todas las instrucciones de instalación y operación durante el uso de este instrumento.

La conexión de este instrumento debe ser hecha de acuerdo con las normas del Código Eléctrico Nacional (ANSI/NFPA 70-1996) de EE. UU., además de cualquier otra norma de seguridad correspondiente a su establecimiento.

La instalación, operación y mantenimiento de este instrumento debe ser realizada por personal calificado solamente. El Código Eléctrico Nacional define a una persona calificada como "una que esté familiarizada con la construcción y operación del equipo y con los riesgos involucrados."

AVERTISSEMENT

Si l'instrument est mal connecté, la mort, des blessures graves, ou un danger d'incendie peuvent s'en suivre. Lisez attentivement ce manuel avant de connecter l'instrument. Lorsque vous utilisez l'instrument, suivez toutes les instructions d'installation et de service.

Cet instrument doit être connecté conformément au National Electrical Code (ANSI/NFPA 70-1996) des Etats-Unis et à toutes les exigences de sécurité applicables à votre installation.

Cet instrument doit être installé, utilisé et entretenu uniquement par un personnel qualifié. Selon le National Electrical Code, une personne est qualifiée si "elle connaît bien la construction et l'utilisation de l'équipement, ainsi que les dangers que cela implique."

Safety Summary

WARNUNG

Der falsche Anschluss dieses Gerätes kann Tod, schwere Verletzungen oder Feuer verursachen. Bevor Sie dieses Instrument anschliessen, müssen Sie die Anleitung lesen und verstanden haben. Bei der Verwendung dieses Instruments müssen alle Installation- und Betriebsanweisungen beachtet werden.

Der Anschluss dieses Instruments muss in Übereinstimmung mit den nationalen Bestimmungen für Elektrizität (ANSI/NFPA 70-1996) der Vereinigten Staaten, sowie allen weiteren, in Ihrem Fall anwendbaren Sicherheitsbestimmungen, vorgenommen werden.

Installation, Betrieb und Wartung dieses Instruments dürfen nur von Fachpersonal durchgeführt werden. In dem nationalen Bestimmungen für Elektrizität wird ein Fachmann als eine Person bezeichnet, welche "mit der Bauweise und dem Betrieb des Gerätes sowie den dazugehörigen Gefahren vertraut ist."

Safety Summary

Définitions
Les messages d'AVERTISSEMENT préviennent l'utilisateur que certaines conditions ou pratiques pourraient entraîner la mort ou des lésions corporelles.

Les messages de MISE EN GARDE signalent des conditions ou pratiques susceptibles d'endommager "PowerVisa", ses données, d'autres équipements ou biens matériels.

Les messages NOTA attirent l'attention sur certains renseignements spécifiques.

Symboles
Les symboles suivants de la Commission électrotechnique internationale (CEI) figurent sur le panneau arrière supérieur situé à proximité du terminal ou de l'unité cité:

Mise en garde, consultez les documents d'accompagnement (ce manual).

Fonctionnement du terminal ou du dispositif sur le courant alternatif (c.a.).

Fonctionnement du terminal ou de l'unitécourant continu (CC).

Borne conductrice de protection.

Safety Summary

Definitionen
WARNUNGEN informieren den Benutzer darüber, daá bestimmte Bedingungen oder Vorgehensweisen körperliche oder tödliche Verletzungen zur Folge haben können.

VORSICHTSHINWEISE kennzeichnen Bedingungen oder Vorgehensweisen, die zu einer Beschädigung von PowerVisa, seiner Daten oder anderer Geräte bzw. von Eigentum führen können.

HINWEISE machen auf bestimmte Informationen aufmerksam.

Symbole
Die folgenden Symbole der Internationalen Elektrotechnischen Kommission (International Electrotechnical Commission; IEC) befinden sich auf der Abdeck- und Seitenplatte unmittelbar am betreffenden Terminal oder Gerät.

Vorsichtshinweis, siehe Begleitdokumente (dieses Handbuch).

Wechselstrombetrieb des Terminals bzw. Geräts.

Gleichstrombetrieb im Terminal oder Gerät.

Terminal-Schutzleiter.

Safety Summary

Definitions
WARNING statements inform the user that certain conditions or practices could result in loss of life or physical harm.

CAUTION statements identify conditions or practices that could harm the PowerVisa, its data, other equipment, or property.

NOTE statements call attention to specific information.

Symbols
The following International Electrotechnical Commission (IEC) symbols are marked on the top and rear panel in the immediate vicinity of the referenced terminal or device:

Caution, refer to accompanying documents (this manual).

Alternating current (ac) operation of the terminal or device.

Direct current (DC) operation of the terminal or device.

Protective conductor terminal.

Safety Summary

Definiciones
Las ADVERTENCIAS informan al usuario de ciertas condiciones o prácticas que podrían producir lesiones mortales o daño físico.

Las PRECAUCIONES identifican condiciones o prácticas que podrían dañar la PowerVisa, sus datos, otros equipos o propiedad.

Las NOTAS llaman la atención hacia la información específica.

Símbolos
Los siguientes símbolos de la Comisión Internacional Electrotécnica (IEC) aparecen marcados en el panel superior y el posterior inmediatos al terminal o dispositivo en referencia:

Precaución, consulte los documentos adjuntos (este manual).

Operación de corriente alterna (ca) del terminal o dispositivo.

Operación de corriente continua (CC) del terminal o dispositivo.

Terminal de protección del conductor.

Safety Summary

Safety Precautions
The following safety precautions must be followed whenever any type of connection is being made to the instrument.

- Connect the green safety (earth) ground first, before making any other connections.
- When connecting to electric circuits or pulse initiating equipment, open their related breakers. DO NOT install any connection of the instrument on live power lines.
- Connections must be made to the instrument first, then connect to the circuit to be monitored.
- Wear safety glasses and insulated gloves when making connections to power circuits.
- Hands, shoes and floor must be dry when making any connection to a power line.
- Make sure the unit is turned OFF before connecting probes to the rear panel.
- Before each use, inspect all cables for breaks or cracks in the insulation. Replace immediately if defective.

Medidas de seguridad
Las medidas de seguridad siguientes deberán observarse cuando se realice cualquier tipo de conexión al instrumento.

- Antes de hacer cualquier conexión, deberá enchufarse el conector de seguridad verde a tierra.
- Cuando se haga conexiones a circuitos eléctricos o a equipo de activación por pulso, deberá abrirse sus respectivas cajas de seguridad. NO deberá hacerse ninguna conexión del instrumento en líneas eléctricas bajo tensión.
- Las conexiones deberán hacerse primero al instrumento y, luego, al circuito a ser monitorizado.

Safety Summary

- •Al hacer conexiones a circuitos eléctricos, deberá utilizar anteojos y guantes protectores.
- •Sus manos, zapatos y el piso deberán estar secos en todo momento en que se haga una conexión a un cable eléctrico.
- •Verifique que la unidad esté DESACTIVADA antes de conectar sondas en el panel posterior.
- •Previo a cada uso, deberá verificarse que los cables no estén rotos y que el material aislante no tenga rajaduras. Reemplace de inmediato cualquier parte defectuosa.

Mesures de Sécurité
Les mesures de sécurité suivantes doivent être prises chaque fois qu'un type de connexion quelconque est effectué sur l'instrument.

- •Connecter d'abord la prise de terre de sécurité verte (terre) avant d'effectuer toute autre connexion.
- •Ouvrir les disjoncteurs correspondants lors d'une connexion à des circuits électriques ou à des équipement de génération d'impulsions. NE PAS effectuer de connexion d'instrument sur des lignes électriques sous tension.
- •Une fois toutes les connexions de l'instrument effectuées, connecter au circuit à contrôler.
- •Porter des lunettes de protection et des gants isolants pour effectuer des connexions aux circuits électriques.
- •S'assurer que les mains, les chaussures et le sol soient secs lors de connexions à une ligne électrique.
- •S'assurer que l'unité est ÉTEINTE avant de connecter les sondes au panneau arrière.

•Inspecter tous les câbles, avant chaque utilisation, pour s'assurer que les isolants ne sont pas coupés ou fendus. Remplacer immédiatement tous les équipements défectueux.

Sicherheitsvorkehrungen

Die folgenden Sicherheitsvorkehrungen sind immer dann zu befolgen, wenn eine Verbindung zum Instrument hergestellt wird.

•Schließen Sie zuerst die grüne Sicherheits-/Erdleitung an, bevor Sie eine andere Verbindung herstellen.
•Öffnen Sie beim Anschluß an elektrische Stromkreise oder Impulsauslösungseinrichtung en die entsprechenden Unterbrecher. Es dürfen KEINE Anschlüsse an das Instrument unter stromführenden Spannungsleitungen montiert werden.
•Die Verbindungen müssen zuerst am Instrument und danach an der zu überwachenden Schaltung hergestellt werden.
•Tragen Sie Schutzbrillen und Isolierhandschuhe, wenn Sie Anschlüsse an den Stromkreisen vornehmen.
•Hände, Schuhe und Fußboden müssen trocken sein, wenn Sie Anschlüsse an den Stromkreisen durchführen.
•Stellen Sie sicher, daß das Gerät AUSgeschaltet ist, bevor Sie an der rückwärtigen Konsole Meßfühler anschließen.
•Prüfen Sie vor jedem Gebrauch alle Kabel auf Bruchstellen und Risse in der Isolierung. Wechseln Sie schadhafte Kabel sofort aus.

FCC Statement

This device has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his/her own expense.

Warranty

Dranetz-BMI warrants that the 100G PowerVisa will be free from defects in workmanship and materials for a period of one year from the date of purchase. Dranetz-BMI will, without charge, replace or repair, at its option, any warranted product returned to the Dranetz-BMI factory service department.

Dranetz-BMI shall not be held liable for any consequential damages, including without limitation, damages resulting from loss of use, or damages resulting from the use or misuse of this product. Some states do not allow limitations of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This warranty gives you specific rights and you may also have rights which vary from state to state.

Exclusions: *This warranty does not apply in the event of misuse or abuse of the product or as a result of unauthorized repairs or alterations.*

Need Help?

How to Contact Dranetz-BMI

Regardless of your location, Dranetz-BMI sales and product support are within easy reach through an established network of representatives and distributors worldwide.

For Sales, Technical Support, or the name of a Dranetz-BMI Sales Representative in your area, call:

1-800-372-6832 or 732-287-3680

Fax: 732-248-1834

Web site: www.dranetz-bmi.com

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Welcome to the 100G PowerVisa

1

Why use a power monitor?
A power monitor will help you rule out power as a possible cause of equipment problems. It can also help you find the source of a power disturbance and choose a reasonable solution.

What are power disturbances?
Power disturbances are "glitches" in the power that pose a threat to your productivity, customer relations, and employee morale.

What causes them?
Most power disturbances are caused by equipment, both inside and outside of your facility. Other causes include lightning, loose wires, static, radio transmitters, and utility adjustments to the power line.

Power disturbances are increasing. Why?
For two reasons. First, power systems in most countries were designed well before the microprocessor. They deliver power that's great for running motors and lighting lights but not for powering sensitive electronics. Second, electronic equipment can cause power disturbances.

Are there different kinds of power disturbances?
Yes, generally they're classed according to their duration and intensity. Impulses are very fast, intense bursts of energy. There are also waveshape faults, sags and swells, frequency errors, high-frequency noise, power failures, and harmonic distortion. The PowerVisa detects all of these, plus wiring errors and temperature variations.

What damage do they do?
Power disturbances occur randomly and can be difficult to diagnose. They often appear to be hardware or software problems, and therefore needlessly increase the time and money spent on parts and service. They can also damage and disrupt electronic equipment and systems, and may cause safety hazards.

1 Welcome to the 100G PowerVisa

How do I find out if I have a problem?
Monitor your power for a business cycle, typically one week. During this time keep a log noting the time and description of any equipment disruptions, then correlate the results with the PowerVisa's ALL-graph.

How do I monitor power? Is it dangerous?
With the PowerVisa, you simply plug it into the wall outlet as close to your sensitive equipment as possible. We've made it very easy and it's not dangerous. (See the Quick Start section on page 4).

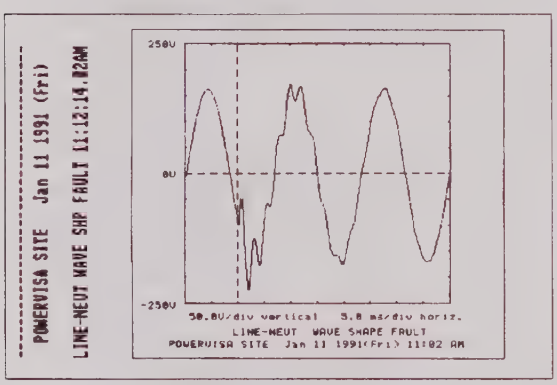
If I do have a power problem, what can I do about it?
First, you could refer to the PowerVisa's Advice messages (see page 5) to get some idea of what might be the cause of the problem. Second, you could use the PowerVisa to gather more detailed information (disturbance graphs) that either you or a person trained in power troubleshooting could use to solve the problem. Once you have these graphs, refer to Dranetz-BMI's Handbook of Power Signatures for more help in determining what's causing the disturbance. (See page 39).

Welcome to the 100G PowerVisa

1

What is a disturbance graph?

It's a detailed "picture" showing how electricity has been disrupted from its normal wave-like path. The PowerVisa prints these graphs when power crosses imaginary lines called thresholds (See pages 15 and 16); thresholds actually define the power disturbance. Your PowerVisa can automatically set its own thresholds, so you don't have to worry about this.

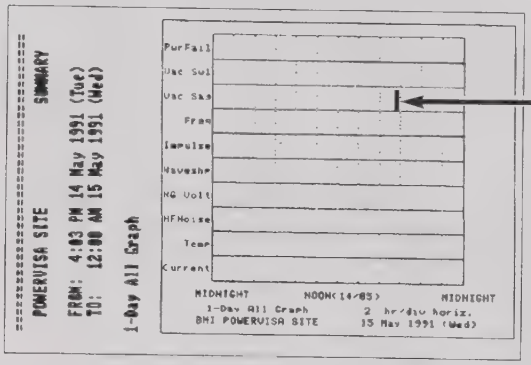


What else should I know?

Until very recently, only power experts with years of training could troubleshoot power problems. Now, with your PowerVisa, you can go a long way in solving (and understanding) power and how it affects your equipment.

2 Quick Start

1. **Plug in your PowerVisa.**
2. **Press the Advice button 3 times.**
   Your PowerVisa clears its memory, selects thresholds, turns automatic print off, then starts to monitor.
3. **Wait** for a time to allow your PowerVisa to collect some data.
4. **Press the Summary button.**
   Your PowerVisa will print an ALL-graph showing how many and what type of disturbances occurred.



This ALL-graph shows a low voltage disturbance occurred at about 5:30 p.m.

Was your equipment disrupted at 5:30? If so, you'll want to know more about the power disturbance, so...

5. **Press the Events button.**
   Your PowerVisa will print the list of disturbances.

```
POWERVISA SITE                    EVENTS

FROM:  4:03 PM 14 May 1991 (Tue)
TO:    8:33 AM 15 May 1991 (Wed)

-----------------------------------
     LINE-NEUTRAL VOLTAGE SAGS
-----------------------------------

Tue 14/05/91  5:33:43.6PM
     Duration:                 0.7 sec
     Minimum voltage:         98.1 Vrms
```

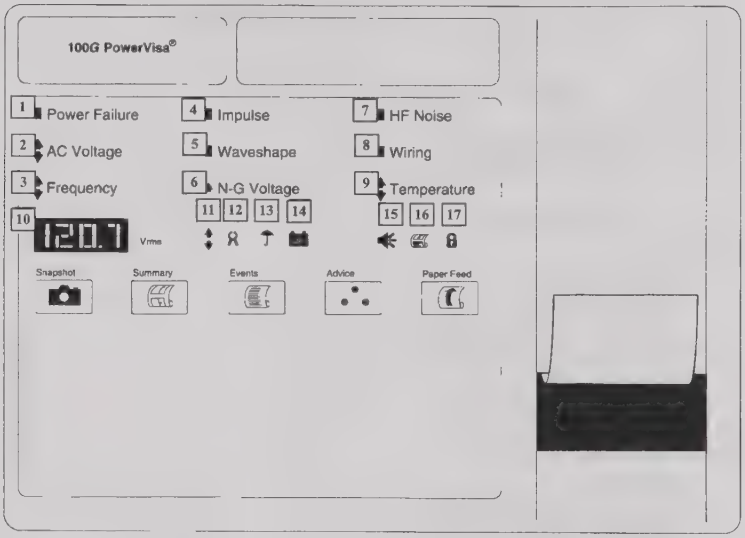
This events printout shows voltage fell to 98.1 volts.

6. **Press the Advice button.**
   Your PowerVisa will print a message about the possible causes and solutions to your power problem.

```
=====================================
 POWERVISA SITE              ADVICE
-------------------------------------
     LINE-NEUTRAL VOLTAGE SAGS
-------------------------------------

  Tue 14/05/91  5:33:43.6PM

Possible causes:
  A - Loads may have been turned on.
      If the load current
      specifications were within your
      limit, you should consider
      start-up currents for motors and
      electronic loads;
  B - The mechanical load may have
      been increased on a motor;
  C - Sag associated with a power
      failure (either local or
      utility);
  D - Incorrectly set transformer tap;
  E - Failure of voltage regulator on
      UPS or regulating transformer;
  F - Loss of one phase on a three-
      phase or split-phase system;
  G - Your sag threshold may be set
      incorrectly.

Possible solutions:
  1 - Remove the cause;
  2 - Install a fast-response
      regulating transformer;
  3 - Move the offending load to
      another circuit;
  4 - Move the sensitive load to
      another circuit;
  5 - Increase the rating of the
      distribution system to allow
      higher currents;
  6 - Improve the power factor of the
      circuit to reduce current flow.
```

7. **For more set up and operation information, press the Help! key at any time .**

3 Front and Side Panels



PowerVisa LEDs

1 **Power Failure** - Lights when voltage falls below the power failure threshold.

2 **AC Voltage** - Lights when voltage exceeds RMS sag or swell thresholds.

3 **Frequency** - Lights when frequency crosses the threshold.

4 **Impulse** - Lights when a L-N or N-G impulse exceeds the threshold.

5 **Waveshape** - Lights when waveshape fault is detected.

6 **N-G Voltage** - Lights when neutral-to-ground voltage exceeds threshold.

7 **H-F Noise** - Lights when high frequency noise exceeds threshold.

8 **Wiring** - Lights when neutral and phase conductors are reversed, or no ground is present.

9 **Temperature** - Lights when temperature crosses a threshold.

10 **Display window** - Shows RMS line voltage and other selected values when monitoring; shows value being set during setup.

11 **Current up/down arrow LEDs** - If a SmartProbe is plugged into the SmartProbe Input socket, lights when thresholds are crossed.

12 **SmartProbe Input LED** - Lights when SmartProbe is connected to the SmartProbe Input socket.

13 **Humidity probe LED** - Check factory for availability. Lights when humidity probe is connected to SmartProbe input socket.

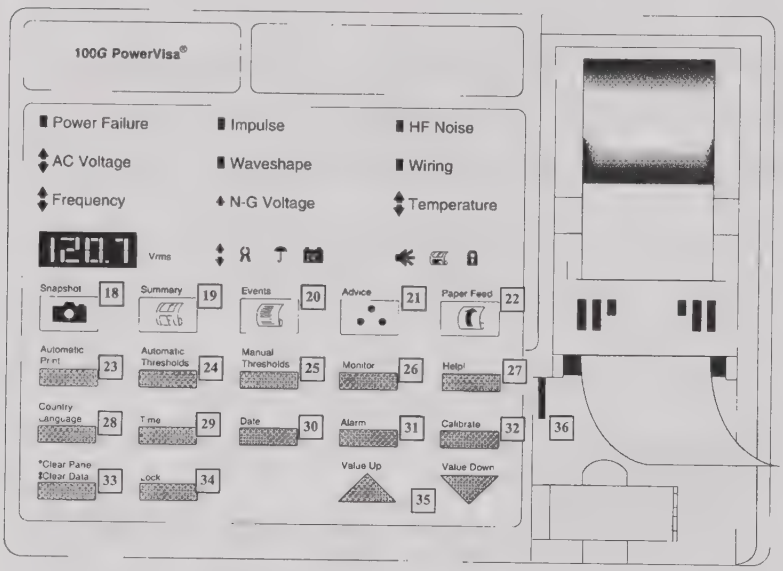
14 **DC Probe LED** - Check factory for availability. Lights when DC probe is connected to SmartProbe socket.

15 **Alarm LED** - Lights when alarm is on. When turned on, the alarm will sound 3 beeps when any threshold is exceeded.

16 **Automatic print LED** - Lights green when Automatic Print is on, flashes or lights red when the printer is out of paper or the paper release lever is in the wrong position.

17 **Lock LED** - Lights when you have locked the keyboard.

3 Front and Side Panels



To access hidden buttons, lift up the PowerVisa's hinged cover.

PowerVisa Buttons

Remember, you can monitor the power line, detect disturbances, and get an Advice printout without ever having to lift you PowerVisa's cover. See pages 4 and 5.

18 **Snapshot** - Press once for a report on the present condition of voltage, frequency, high-frequency noise, current, and temperature. Press again with 21 seconds for initial waveshapes, and press once more for a Harmonics Report.

19 **Summary** - Press once for an All-graph and thresholds report. Press again within 2 minutes for summary graphs.

20 **Events** - Prints the 10 worst events for each measured parameter.

21 **Advice** - Prints information about the possible causes and solutions to the most recent printout. Press three times for automatic start.

22 **Paper Feed** - Advances the paper.

23 **Automatic Print** - Toggles the Automatic Print LED on and off. When on, this causes disturbance graphs to print as they occur and summary graphs and the All-graph to print at midnight. See pages 35-37.

24 **Automatic Thresholds** - Sets thresholds automatically based on country, frequency, and voltage. See page 15.

25 **Manual Thresholds** - Puts the PowerVisa into manual thresholds mode so you can choose your own thresholds. Also stores 2 sets of thresholds. Lights corresponding LED and displays present threshold for each parameter

26 **Monitor** - Causes the PowerVisa to begin monitoring immediately.

27 **Help!** - Prints messages explaining setup and operation of the PowerVisa. Press **Help!** then press any other button within 2 seconds to get specific help on that button.

28 **Country/Language** - Sets country/language combination on which Automatic Thresholds, date, and temperature formats are based, and language in which Help! and Advice messages will be printed.

29 **Time** - Sets time. Press to display 24-hour clock, then use the **Value Up/Value Down** buttons to move to the correct setting.

30 **Date** - Sets date. Press once to display a month/day format (either MM:DD for Month:Day or DD:MM for Day:Month depending on your country setting). Change using the **Value Up/Value Down** buttons. Press **Date** again to display the year, which is also changed using the **Value Up** or **Value Down** buttons. You must clear data in memory to set date and time.

31 **Alarm** - Turns alarm on or off and turns lights alarm LED on or off.

32 **Calibrate** - Press to print a Calibration Report. Press twice to initiate the calibration procedure, and a third time to lock it in. See Chapter 13.

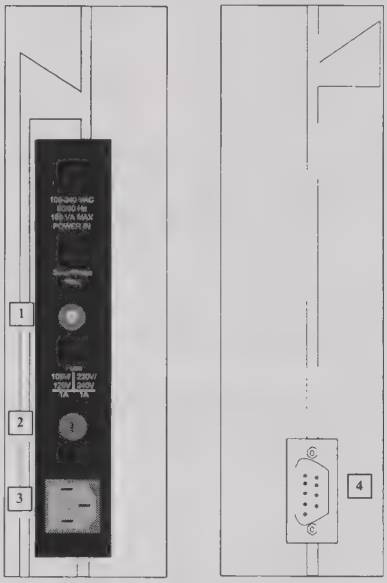
33 **Clear Panel/Clear Data** - The first press clears disturbance LEDs, the second press (within 2 seconds) clears disturbance data from memory. (This does not change the thresholds.) Press this button followed by **Value Up** to reset.

34 **Lock** - Locks keyboard. To unlock, press **Lock**, then **Clear Panel**.

35 **Value Up/Value Down** - Increases or decreases settings in display for setup purposes.

36 **Release lever** - Releases paper guide when loading paper.

3 Front and Side Panels



PowerVisa Connectors

1. **SmartProbe input socket** - See page 51.
2. **Fuse** - One amp, 5 x 20 mm, fast blow.
3. **Power cord socket.**
4. **Automatic test socket for Dranetz-BMI use.**

Low voltage power failure

When power falls below the threshold you set for power failure (see pages 16-18):

1. Your PowerVisa continues to operate for 6 seconds if its NiCad battery is sufficiently charged.
2. The **Power Failure LED** will light, and the **Waveshape Fault LED** may light.
3. All data and threshold settings will be saved in memory.

Your PowerVisa's internal lithium battery retains data and threshold settings. It should be replaced by Dranetz-BMI every 5 years.

The NiCad battery, located under the front cover below the printer, provides an orderly shutdown under low-voltage conditions. It tolerates 2 power failures per charge. When it is low, your PowerVisa may not be able to store power failure information correctly. Monitor for at least 14 hours to charge the battery.

The NiCad battery should be replaced every 18-24 months. Replace only with rechargeable NiCad battery - Sanyo model #N-6PT or equivalent.

When the NiCad battery is low, your PowerVisa may not be able to store power failure information correctly. Keep your PowerVisa monitoring for 14 hours to allow the battery to charge.

Setting Country and Language 5

To Set Country and Language:

1. Press the **Country/Language** button, then the **Help!** button. The PowerVisa will respond by printing a numbered list of country/language combinations.

```
Use [Value Up]/[Value Down] to
choose one of the following country/
language pairs.

 Menu
 Choice  Country       Language
 ======  ==========    ==========
      1  U.S.A.        English
      2  CANADA        Français
      3  CANADA        English
      4  DEUTSCHLAND   Deutsch
      5  GERMANY       English
      6  FRANCE        Français
      7  FRANCE        English
      8  ENGLAND       English
      9  ITALIA        Italiano
     10  ITALY         English
     11  ESPANA        Español
     12  SPAIN         English
     14  JAPAN         English
```

2. Use the **Value Up/Value Down** buttons to display the number of the country/language pair that is appropriate for your situation. Your PowerVisa may have fewer choices available than listed on the Help message; your choices depend on the languages you specified when ordering your PowerVisa.

Your language selection applies to the Help and Advice messages. The country selection pertains to automatic threshold selections. See page 16. Press the **Monitor** button or unplug your PowerVisa to activate any changes you make to the country/language setting.

In some countries a neutral-to-ground bond is optional. If you are in one of these countries and the PowerVisa determines that neutral and ground are not bonded, the PowerVisa will not monitor (or report) neutral to ground.

Setting Automatic Thresholds 6

To Set Automatic Thresholds:

1. Press the **Automatic Thresholds** button. Your PowerVisa will set appropriate thresholds for the power it is monitoring based on the country you have selected.

The table on the next page shows the PowerVisa's Automatic Threshold settings.

Once you've pressed the **Automatic Threshold** button, the PowerVisa will monitor using these thresholds (listed on the following page) until you change them. For this reason, it's a good idea to set new thresholds every time you move the PowerVisa. Data in memory is preserved when you change thresholds.

6 Setting Automatic Thresholds

	Voltage	Freq.	Freq. Tol.	Swell	Sag	Impulse	Power Failure
Canada	120 Vrms	60 Hz	0.6 Hz	128 Vrms	105 Vrms	200 Vpk	84 Vrms
	208 Vrms	60 Hz	0.6 Hz	221 Vrms	183 Vrms	300 Vpk	146 Vrms
	240 Vrms	60 Hz	0.6 Hz	255 Vrms	211 Vrms	400 Vpk	168 Vrms
	277 Vrms	60 Hz	0.6 Hz	290 Vrms	243 Vrms	400 Vpk	194 Vrms
EC	230 Vrms	50 Hz	0.5 Hz	244 Vrms	216 Vrms	400 Vpk	161 Vrms
France	127 Vrms	50 Hz	0.5 Hz	140 Vrms	114 Vrms	200 Vpk	89 Vrms
	220 Vrms	50 Hz	0.5 Hz	243 Vrms	198 Vrms	400 Vpk	154 Vrms
Germany	127 Vrms	50 Hz	0.5 Hz	134 Vrms	120 Vrms	200 Vpk	89 Vrms
	220 Vrms	50 Hz	0.5 Hz	243 Vrms	198 Vrms	400 Vpk	154 Vrms
Italy	127 Vrms	50 Hz	0.5 Hz	140 Vrms	114 Vrms	200 Vpk	89 Vrms
	220 Vrms	50 Hz	0.5 Hz	243 Vrms	198 Vrms	400 Vpk	154 Vrms
Japan	100 Vrms	50 Hz	0.5 Hz	111 Vrms	90 Vrms	200 Vpk	70 Vrms
	200 Vrms	50 Hz	0.5 Hz	221 Vrms	180 Vrms	300 Vpk	140 Vrms
	100 Vrms	60 Hz	0.5 Hz	111 Vrms	90 Vrms	200 Vpk	70 Vrms
	200 Vrms	60 Hz	0.5 Hz	221 Vrms	180 Vrms	300 Vpk	140 Vrms
Spain	127 Vrms	50 Hz	0.5 Hz	136 Vrms	118 Vrms	200 Vpk	89 Vrms
	220 Vrms	50 Hz	0.5 Hz	236 Vrms	204 Vrms	400 Vpk	154 Vrms
UK	240 Vrms	50 Hz	0.5 Hz	255 Vrms	225 Vrms	400 Vpk	168 Vrms
USA	120 Vrms	60 Hz	0.6 Hz	128 Vrms	105 Vrms	200 Vpk	84 Vrms
	208 Vrms	60 Hz	0.6 Hz	221 Vrms	183 Vrms	300 Vpk	146 Vrms
	240 Vrms	60 Hz	0.6 Hz	255 Vrms	211 Vrms	400 Vpk	168 Vrms
	277 Vrms	60 Hz	0.6 Hz	290 Vrms	243 Vrms	400 Vpk	194 Vrms

Waveshape Faults: 20% deviation over 0.10 cycle
Temperature: 86°F (30°C), 59°F (15°C)
High-frequency Noise: 15 Vpk
Current: surge-70% of probe rating (A-115 - 42 Arms; A-116 - 420 Arms); sag-0 Arms

■ **Table 1: Automatic Thresholds table.**

Automatic thresholds depend on the country setting. Make sure you set your PowerVisa for the country where you are using it. See page 13.

Setting Manual Thresholds 7

Why Use Manual Thresholds?

The PowerVisa's automatic threshold settings listed on the previous page are reasonable in most instances. But, if your PowerVisa is printing too many graphs or reporting too many disturbances, you might want to change thresholds. To determine reasonable settings, consider the operating envelope of the equipment for which you want to monitor power.

How to Set Manual Thresholds:

1. Press the **Manual Thresholds** button. This causes **0** to appear in the display, indicating the last set of manual thresholds used.
2. Press the **Value Up** or **Value Down** buttons to select either a memory (**1** or **2**) in which to store a set of manual thresholds or the working slate (**0**). Any changes you make to memories 1 or 2 are automatically stored. You can make changes to the working slate, and monitor using these new settings, but they won't be stored.
3. Press the **Manual Thresholds** button again to cause the **Power Failure LED** to light. If desired, change the threshold for power failure using the **Value Up/Value Down** buttons, or continue pressing the **Manual Thresholds** button to advance to the threshold you wish to change, signaled by its lighted LED.

The PowerVisa automatically begins monitoring 10 seconds after the last button has been pressed. If you haven't finished your setup before this occurs, simply press the **Manual Thresholds** button again and restart.

How to Recall a Setup from Memory:

Your PowerVisa stores up to 2 sets of manually-adjustable threshold setups.

1. Press the **Manual Thresholds** button. **0** will appear in the display.
2. Use the **Value Up** or **Value Down** button to choose which memory (**1** or **2**) you wish to recall.
3. Press the **Monitor** button to begin monitoring immediately or press the **Manual Thresholds** button repeatedly to check the individual threshold settings.

Data in memory is preserved when you change thresholds. To clear memory, press the **Clear Data/Clear Panel** button twice.

7 Setting Manual Thresholds

Power Failure:

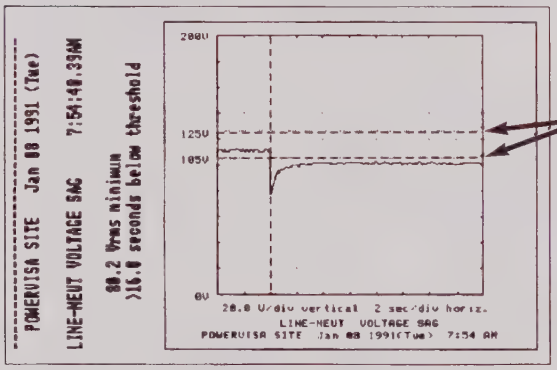
1. Press the **Manual Thresholds** button until the **Power Failure LED** lights and the present power failure threshold is displayed. While monitoring, if voltage falls below threshold you set here, your PowerVisa's **Power Failure LED** will light and stay lit until you clear the display.
2. Use the **Value Up** or **Value Down** buttons to set the threshold.

Setting Manual Thresholds 7

AC Voltage (Sag and Swell):

1. Press the **Manual Thresholds** button until the AC **Voltage Up Arrow LED** lights to indicate you are setting the swell threshold. The threshold value will be displayed. While monitoring, if the voltage crosses this threshold, your PowerVisa's **AC Voltage Up Arrow LED** will light.
2. Use the **Value Up** or **Value Down** buttons to change the swell threshold. Press the **Manual Thresholds** button again so the **Down Arrow LED** flashes and set the sag threshold.

Your PowerVisa won't let you set a sag threshold which is above the swell threshold or a swell threshold which is below the sag threshold. When necessary, the PowerVisa will adjust its thresholds to accommodate this rule.



You are setting these thresholds.

The sag threshold range is 84 Vrms-249 Vrms; the swell threshold range is 90 Vrms-270 Vrms.

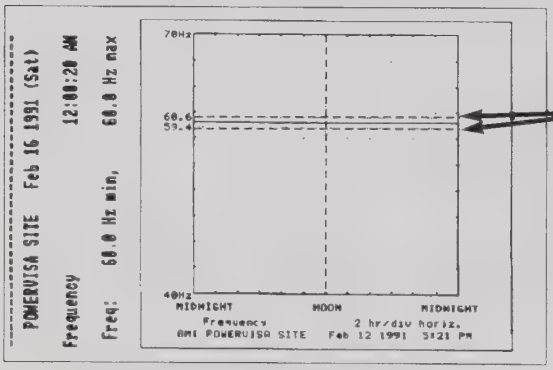
Data in memory is preserved when you change thresholds. To clear memory, press the **Clear Data/Clear Panel** button twice.

7 Setting Manual Thresholds

Frequency:

1. Press the **Manual Thresholds** button until the **Frequency Up Arrow LED** lights and the present high-frequency threshold is displayed. While monitoring, if frequency crosses this threshold, your PowerVisa's **Frequency Up Arrow LED** will light.
2. Use the **Value Up** or **Value Down** buttons to set the threshold, then press the **Manual Thresholds** button once so the **Down Arrow LED** lights and set the low-frequency threshold.

Your PowerVisa won't let you set a low-frequency threshold which is above the high-frequency threshold or a high-frequency threshold which is below the low-frequency threshold.

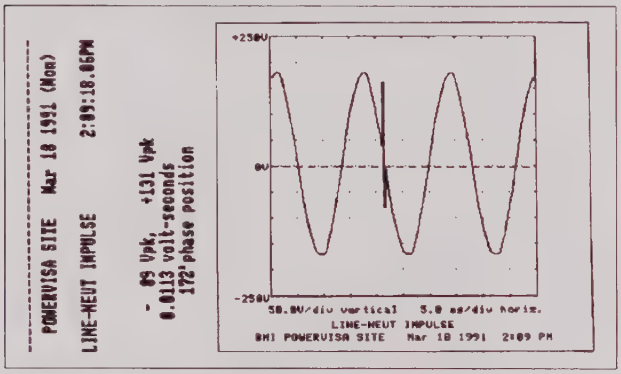


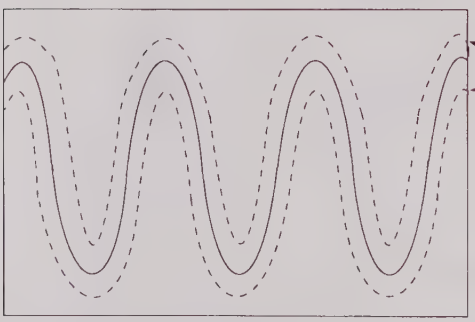
You are setting these thresholds.

The range is 45 Hz-65 Hz.

Impulse:

1. Press the **Manual Thresholds** button until the **Impulse LED** lights and the present impulse threshold is displayed. While monitoring, if the signal crosses this threshold, your PowerVisa's **Impulse LED** will light. The threshold you set here applies to both line-to-neutral (L-N) and neutral-to-ground (N-G) impulses.
2. Use the **Value Up** or **Value Down** buttons to set the threshold.





You are setting this threshold.

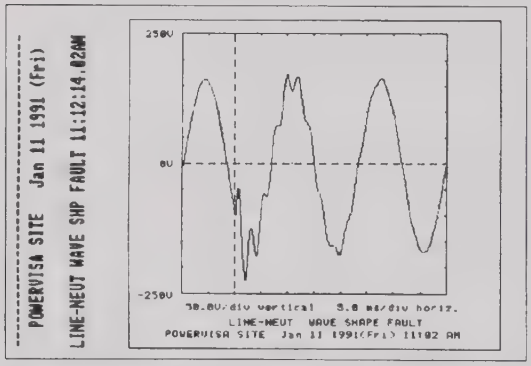
The range is 100-2000 Vpk. If impulses occur on two consecutive cycles (waveforms), your PowerVisa reports the largest of the two impulses, annotated with amplitude, polarity, volt-seconds, and phase position.

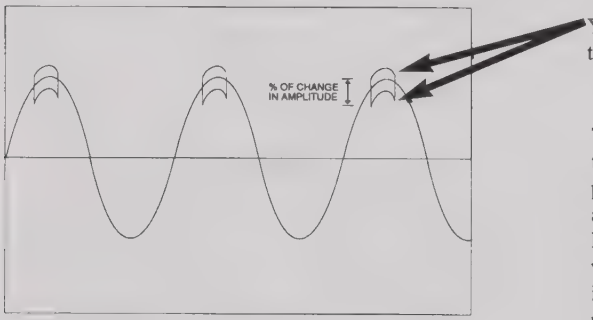
■ **Figure 1: Impulse threshold. Thresholds track the waveform.**

7 Setting Manual Thresholds

Waveshape Fault:

1. Press the **Manual Thresholds** button until the **Waveshape LED** lights and the present setting is displayed. Waveshape faults are determined by comparing samples from the previous cycle to corresponding samples in the present cycles. See Figure 2.
2. Use the **Value Up** or **Value Down** buttons to set this threshold as a percentage of nominal voltage.





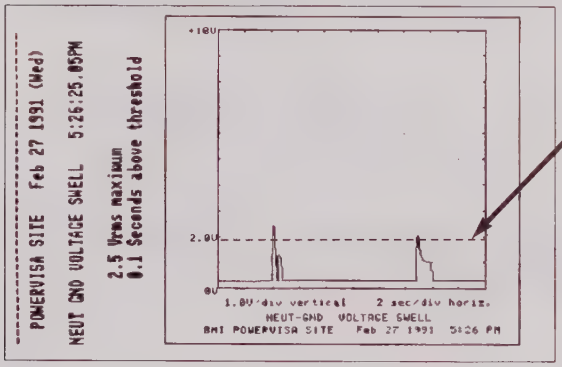
You are setting these thresholds.

■ **Figure 2: Waveshape Fault detection.**

The threshold setting is the maximum percentage of change allowed before your PowerVisa will print a waveshape fault. This is expressed as a percentage of nominal voltage. Your PowerVisa always compares 0.1% to 99% of nominal voltage. If you want to turn waveshape fault graphs off, enter 0%.

N-G Voltage Swell:

1. Press the **Manual Thresholds** button until the **N-G Voltage LED** lights and the present threshold setting for N-G (neutral-ground) Voltage is displayed. While monitoring, if voltage crosses this threshold, your PowerVisa's **N-G Voltage LED** will light.
2. Use the **Value Up** or **Value Down** buttons to set the threshold.



You are setting this threshold.

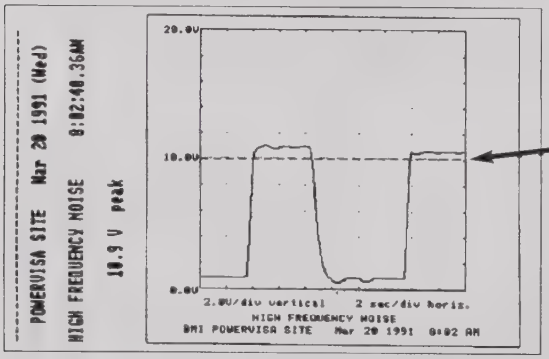
The range for this setting is 0.1-145.0 Vrms.

In some countries a neutral-to-ground bond is optional. If you are in one of those countries and the PowerVisa determines that neutral and ground are not bonded, the PowerVisa will not monitor (or report) neutral to ground.

7 Setting Manual Thresholds

High Frequency (HF) Noise:

1. Press the **Manual Thresholds** button until the **HF Noise LED** lights and the present threshold setting for high frequency noise is displayed. While monitoring , if the signal crosses this threshold, your PowerVisa's **HF Noise LED** will light. HFN has a frequency range of 5 kHz-1 MHz.
2. Use the **Value Up** or **Value Down** buttons to change the setting.



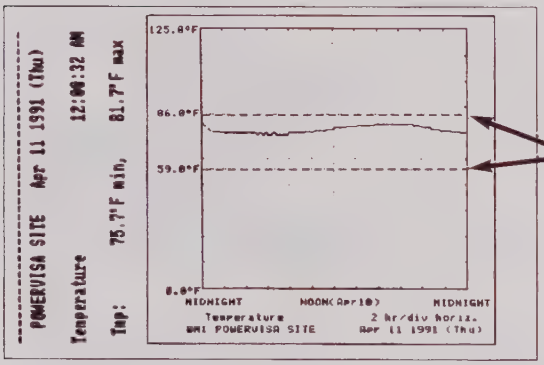
You are setting this threshold.

The range is 0.0-20.0 Vpk.

Setting Manual Thresholds 7

Temperature:

1. Press the **Manual Thresholds** button until the **Up Arrow Temperature LED** lights and the present high-temperature threshold is displayed. While monitoring, if temperature crosses this threshold, you PowerVisa's **Temperature Up Arrow LED** will light.
2. Use the **Value Up** or **Value Down** buttons to set the high-temperature threshold. Your PowerVisa chooses Centigrade or Fahrenheit automatically, depending on the country selected. Then press the **Manual Thresholds** button once so the **Down Arrow Temperature LED** lights. Set the low-temperature threshold.



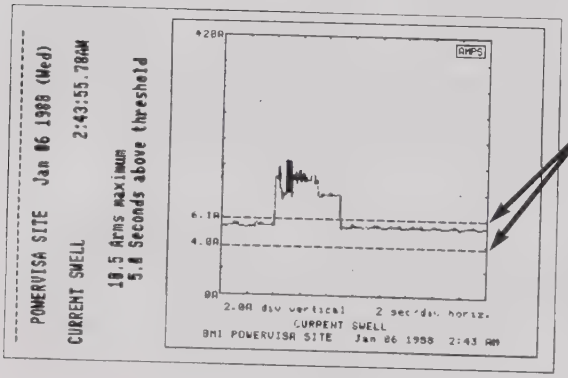
You are setting these thresholds.

The range is -3°C-+40°C or +26°F-+104°F.

7 Setting Manual Thresholds

Current:

1. Connect a SmartProbe to your PowerVisa. See page 27. The corresponding **SmartProbe LED** lights indicating the PowerVisa recognizes the SmartProbe. Press the **Snapshot** button to get a printout that shows the measured current of the line you are monitoring.
2. Press the **Manual Thresholds** button until the **Up Arrow Current LED** lights and the present threshold for current is displayed.
3. Use the **Value Up** or **Value Down** buttons to change the current swell threshold, then press the **Manual Thresholds** button to get the **Down Arrow Current LED** to light and change the current sag threshold. (If you don't want to see low current disturbances, set the low current threshold to 0.0 Amps).



You are setting these thresholds.

The range is dependent on which SmartProbe you have connected. With the PowerVisa, the A-115 has a range of 1-60 A, the A-116 has a range of 10-600 A.

Monitoring Current:

1. When you monitor current with you PowerVisa, initial waveshape graphs and waveshape fault graphs show both voltage and current. To monitor current with the PowerVisa, you need:

    - An A-115 or an A-116 SmartProbe
    - Access to phase current only

Connect your SmartProbe to the PowerVisa's SmartProbe input socket. Then attach the SmartProbe to the phase conductor or use a line splitter such as the one shown here. For maximum accuracy, center the wire in the SmartProbe.

The model 151-2 line splitter from Simpson separates the conductors so you can attach an A-116 SmartProbe to monitor current.

Simpson Electric Co.
853 Dundee Ave.
Elgin, IL 60120
Phone: 847/697-2260
Fax: 847/697-2272

Displaying Meter Readings 9

While it's monitoring, your PowerVisa displays the present value for L-N RMS voltage. You can view the present values for other measurements by pressing the **Monitor** button. For example, press the **Monitor** button once to light the **Frequency LEDs**. The value in the display will be the present frequency reading.

Press the **Monitor** button repeatedly to scroll through these other readings:

- N-G voltage
- HF Noise
- Temperature
- Current (if a SmartProbe is installed)
- L-N voltage

In some countries a neutral-to-ground bond is optional. If you are in one of those countries and the PowerVisa determines that neutral and ground are not bonded, the PowerVisa will not monitor (or report) neutral to ground.

Printing Reports 10

Power Disturbance Data; Getting What You Need:
Your PowerVisa lets you decide how much information you need. There are 4 types of information: **Snapshot; Stored; Detailed; Solutions**.

- **Snapshot** information gives you an immediate look at the power.
- **Stored** information, that you access after monitoring, provides a general overview of your power quality.
- **Detailed** information, printed when the disturbance occurs, gives you a picture of each power disturbance.
- **Solutions**, in the form of an Advice printout, presents probable causes and possible solutions to printed disturbances.

The following pages describe these reports and what buttons to press to get them.

In some countries a neutral-to-ground bond is optional. If you are in one of those countries and the PowerVisa determines that neutral and ground are not bonded, the PowerVisa will not monitor (or report) neutral to ground.

10 Printing Reports

	Report	How to get it	Information
Snapshot information	Snapshot (1) Status	Press the **Snapshot** button once.*	Prints meter readings on the present condition of the power line, including voltage, frequency high-frequency noise, and current if a SmartProbe is installed, and ambient temperature.
	(2) Initial Wave-shapes	Press the **Snapshot** button twice within 30 seconds.	A graph showing the present condition of the voltage waveshapes and also current if a SmartProbe is installed.
	(3) Harmonic Report	Press the Snapshot button 3 times within 10 seconds.	Prints a meter reading showing Total Harmonic Distortion as a percentage of the voltage (and current) at the fundamental frequency, watts, volt-amps, and power factor.
Detailed Information	Disturbance graphs	Press the **Automatic Print** button to light the **Automatic Print LED**.	Graphs showing pictures of each disturbance printed as they occur.
	Calibration	Press the **Calibrate** button.	A text report providing calibration information.

* If you need a second printout, simply press the **Monitor** button again.

	Report	How to get it	Information
Stored information	ALL-graph	Press the **Summary** button once,* or prints automatically every day at midnight if **Automatic Print** is on and prints automatically every Sunday at midnight if Automatic Print is off.	A graph showing the occurrences of each type of disturbance over either 24 hours or 7 days and the present threshold settings.
	Summaries	Press the **Summary** button twice within 2 minutes,* or print automatically every day at midnight if Automatic Print is on or print automatically every Sunday at midnight if Automatic Print is off.	Twenty-four hour or 7-day strip charts of both line-to-neutral and neutral-to-ground voltage, impulses, plus frequency, high-frequency noise, temperature, and current if a SmartProbe is installed.
	Events	Press the **Events** button.*	A text report describing the worst occurrences of each disturbance type.
Solutions	Advice	Press the **Advice** button within 20 minutes after data has printed.*	A text message suggesting possible solutions to the printed disturbances.

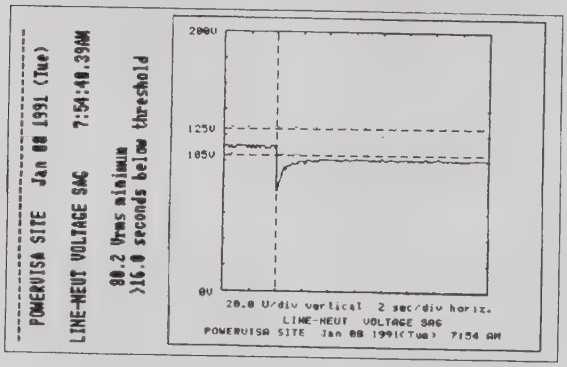
The following pages explain reports that print when Automatic Print is on and how to get ALL-graphs, Summaries, and Events when Automatic Print is off.

* If you need a second printout, simply press the **Monitor** button again.

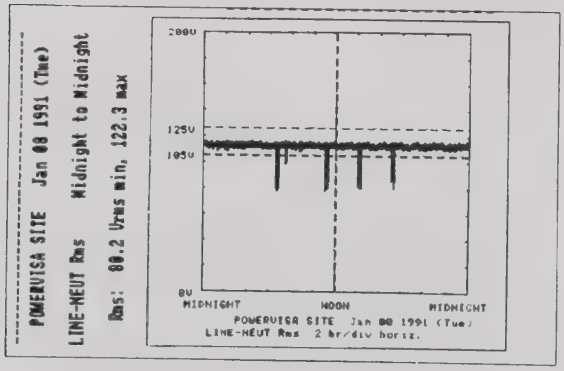
10 Printing Reports

When Automatic Print is On:

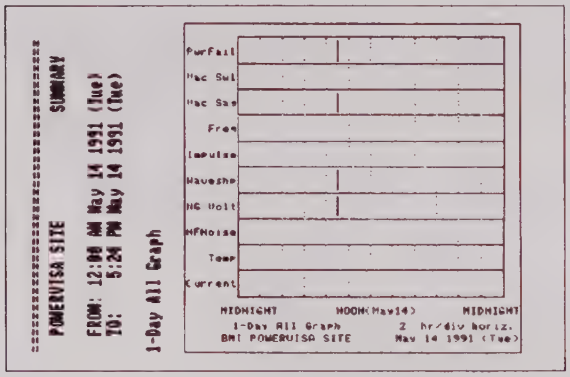
When you press the **Automatic Print** button and light the green **Automatic Print LED**, graphs and text messages print as disturbances occur.



Disturbance graphs print as disturbances occur.



Summary graphs print at midnight.



Disturbance Type	Count
Power Failure	1
L-N Rms Voltage Swell	0
L-N Rms Voltage Sag	1
Frequency	0
Impulse	9
Waveshape Fault	4
N-G Rms Voltage Swell	3
High Frequency Noise	0
Temperature	0
SmartProbe	8

An ALL-graph prints at midnight.

Printing Summaries Only:

You can program your PowerVisa to automatically print just summary data and the ALL-graph (no disturbance graphs). Press the **Automatic Print** button, then within 2 seconds, press the **Value Up** button. The PowerVisa will print the message "**Print only Summaries**" to verify your selection. The **Automatic Print LED** lights green.

Printing Disturbance Graphs Only:

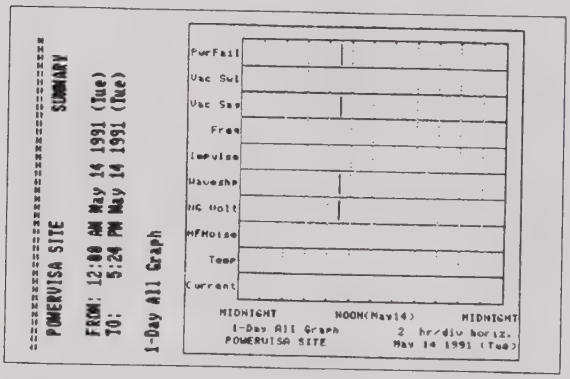
You can program your PowerVisa to print just disturbance graphs (no summary graphs or ALL-graph). Press the **Automatic Print** button, then within 2 seconds, press the **Value Down** button. The PowerVisa will print the message "Print only disturbances" to verify your selection. The **Automatic Print LED** lights green.

When Automatic Print is Off:

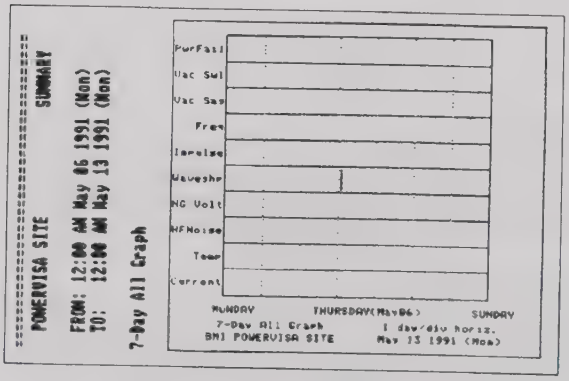
Even when Automatic Print is off you don't have to worry about losing valuable data because every Sunday at midnight your PowerVisa will automatically print an All-graph, summary graphs, and Events, and then clear its memory. In addition, you can get an All-graph, summary graphs, and Events at any time:

Printing an All-graph

Press the **Summary** button once to get an ALL-graph like those shown here.



If the monitoring period has not passed midnight, a 24-hour ALL-graph will print.



If the monitoring period has passed midnight, a 7-day ALL-graph will print.

Printing Summary Graphs:

When Automatic Print is off, print summary graphs by pressing the **Summary** button. Press it once for an ALL-graph, then press again within 2 minutes for summary graphs.

Printing the 10 Worst Events:

In addition to summaries and the ALL-graph, your PowerVisa stores text messages describing the 10 worst events of each disturbance type since it was last cleared.

For a printout of the Events memory, press the Events button:

```
**************************************
  POWERVISA SITE                EVENTS

  FROM: 12:46 AM Jan 01 1988 (Fri)
  TO:    5:18 PM Nov 13 1990 (Tue)

--------------------------------------
    NEUTRAL-GROUND VOLTAGE SWELLS
--------------------------------------

  Tue 11/13/90  3:01:54.53PM
      Maximum voltage:        5.1 Vrms
      Duration:               7.0 sec

  Tue 11/13/90  3:22:46.74PM
      Maximum voltage:        5.1 Vrms
      Duration:               7.0 sec
```

10 Printing Reports

The Events printout includes information on disturbances in memory. (This information stays in memory until you press the **Clear Panel/Clear Data** button twice. Parameters are described with the time and date they occurred in addition to the information listed here:

Power Failures

Line-Neutral Voltage Swells
- duration
- maximum voltage

Line-Neutral Voltage Sags
- duration
- minimum voltage

High Frequency
- maximum frequency

Low Frequency
- minimum frequency

Line-Neutral Impulses
- negative peak
- positive peak
- volt-seconds
- phase position

Neutral-Ground Impulses
- negative peak
- positive peak
- volt-seconds

Line-Neutral Waveshape Faults

High Temperature
- maximum temperature

Low Temperature
- minimum temperature

Current Swells
- duration
- maximum current

Current Sags
- duration
- minimum current

Reading Graphs 11

To determine the cause and solution to power problems, find close matches to your disturbance graphs in the ***Handbook of Power Signatures*** or press the **Advice** button. Advice is based on the type and amplitude of disturbances stored in memory. It applies to the last graph, summary, or set of events printed. For example, for Advice on events, print Events, then press the **Advice** button.

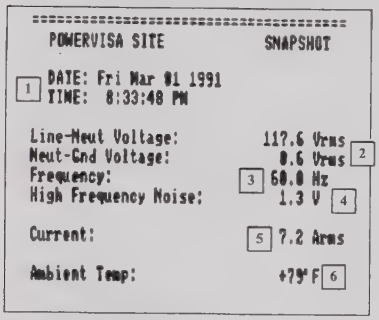
The ***Handbook of Power Signatures*** shows causes, symptoms, and solutions for hundreds of power disturbances. To order, contact Dranetz-BMI Customer Service.

11 Reading Graphs

Snapshot Reports:

A Snapshot Report includes the meter readings shown here, waveshape graphs like that shown on the following page, and a Harmonic report as shown on page 42.

Meter Readings

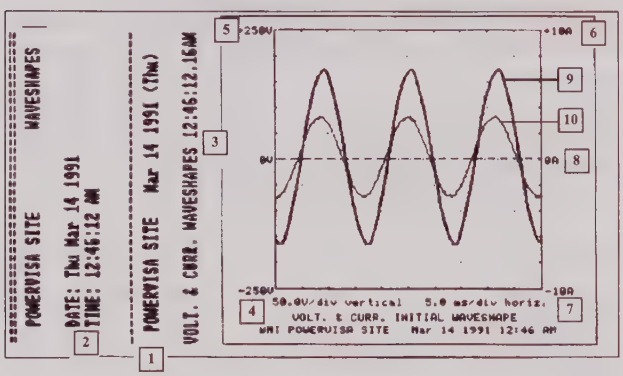


1. **Date and time you printed this report.**
2. **Present voltage reading.**
3. **Present frequency reading.**
4. **Present high-frequency noise reading.**
5. **Current reading** (If SmartProbe is connected).
6. **Temperature reading.**

In some countries a neutral-to-ground bond is optional. If you are in one of these countries and the PowerVisa determines that neutral and ground are not bonded, the PowerVisa will not monitor (or report) neutral to ground.

Waveshape Graphs:

Initial waveshape graphs like the one below print when you press the **Snapshot** button twice. Waveshape fault graphs print whenever the signal crosses the threshold. Waveshape faults are short disturbances that last up to 50 ms. This type of disturbance can occur, for example, when switching from standby to online power. Both waveshape faults and initial waveshape graphs are 50 ms long.



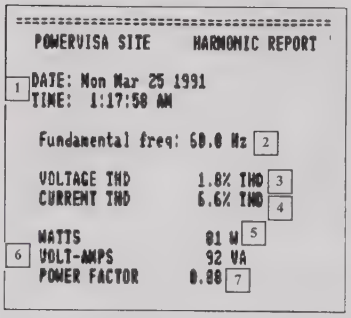
1. **Channel name.** Automatically selected.
2. **Date and time of disturbance or snapshot.**
3. **Type of triggering.** Either snapshot or waveshape fault.
4. **Voltage/division vertical scale.**
5. **Voltage full-scale value.** This value is automatically selected based on the swell threshold.
6. **Current full-scale value.** Appears when SmartProbe is connected.
7. **Horizontal scale.** Five milliseconds per division.
8. **Zero line.** The horizontal axis of the sine wave.
9. **Voltage.**
10. **Current.**

11 Reading Graphs

Harmonic Report:

You can get a report of the percentage of THD (Total Harmonic Distortion) for voltage, and also for current if a SmartProbe is connected, by pressing the **Snapshot** button 3 times. The PowerVisa reports THD as a percentage of the voltage and/or current at the fundamental frequency.

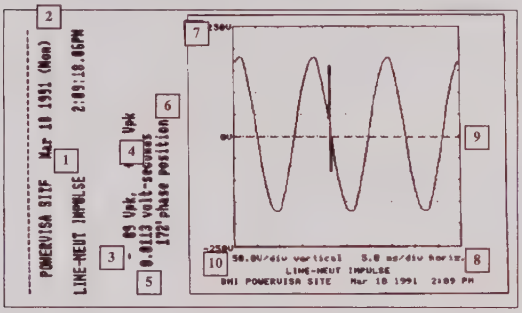
If more than 2-3% voltage THD is present, electronic and other loads may be adversely affected. We suggest you examine the power line with a harmonics analyzer (e.g., the Dranetz-BMI PowerProfiler), which can provide further analysis, or contact Dranetz-BMI for assistance.



1. **Date and time you printed this report.**
2. **Fundamental frequency.**
3. **Percent voltage THD.**
4. **Percent current THD.**
5. **Watts.**
6. **Volt-amps.**
7. **Power factor.** True power factor

Impulse Graphs:

Instantaneous voltage disturbances are impulses. Impulses are caused, for example, by a capacitor switching on line. Impulse graphs are triggered when the voltage exceeds the impulse threshold. Impulse graphs are 50 ms long.



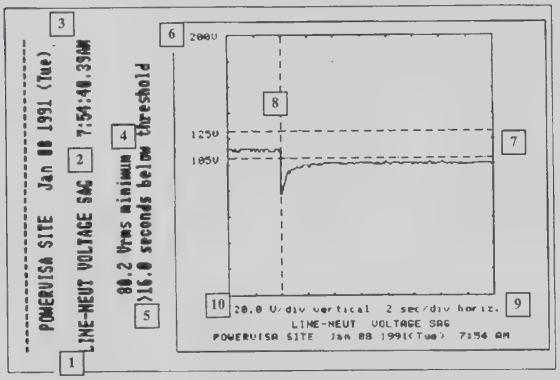
1. **Channel name.**
2. **Date and time the disturbance was recorded.**
3. **Positive peak impulse voltage.** If a ">" (greater than) sign appears in front of the value, the impulse went off-scale.
4. **Negative peak impulse voltage.** If a "<" (less than) sign appears in front of the value, the impulse went off-scale.
5. **Volt-seconds.** The integrated voltage over time of the impulse.
6. **Impulse phase position.** The location on the sine wave where the impulse appeared.
7. **Vertical full-scale.** Automatically selected based on Vrms threshold.
8. **Horizontal scale.** Five milliseconds per division.
9. **Zero line.** The horizontal axis of the sine wave.
10. **Voltage/division vertical scale.**

In some countries a neutral-to-ground bond is optional. If you are in one of these countries and the PowerVisa determines that neutral and ground are not bonded, the PowerVisa will not monitor (or report) neutral to ground.

11 Reading Graphs

Sag/Swell Graphs:

When the RMS voltage crosses the threshold, a sag or swell occurs. A typical cause for this disturbance is a motor start or stop. The Sag/Swell graphs produced by the PowerVisa show 20 seconds of data.



1 **Channel name.** Selected automatically.

2 **Trigger.** There are several phrases that can appear here:

SAG:	The true RMS signal was below the sag threshold at the trigger line.
SWELL:	The true RMS signal was above the swell threshold at the trigger line.
SAG/SWELL:	The true RMS signal went both above and below the sag threshold.
SAG ENDED:	The true RMS signal was below the sag threshold at the left edge of the graph and within the thresholds at the right edge. If the voltage returns to within the sag and swell thresholds before the end of the graph, no SAG ENDED graph will print.
SWELL ENDED:	The true RMS signal was above the threshold at the left edge of the graph and within the thresholds at the right edge. If the voltage returns to within the sag and swell thresholds before the end of the graph, no SWELL ENDED graph will print.

3 **Date and time the disturbance was recorded.**

4 **Minimum and/or maximum voltage or current.**

5 **Duration.** The total length of time the signal was outside the threshold.

6 **Vertical full-scale.** Automatically selected based on the swell threshold.

7 **Swell/Sag threshold lines.**

8 **Trigger line.** The point in time when the PowerVisa determined the RMS signal exceeded the threshold. To the left of the line are 4 seconds of pre-trigger data; to the right are 16 seconds of post-trigger data.

9 **Horizontal scale.** Two seconds per division; divisions marked by tick marks.

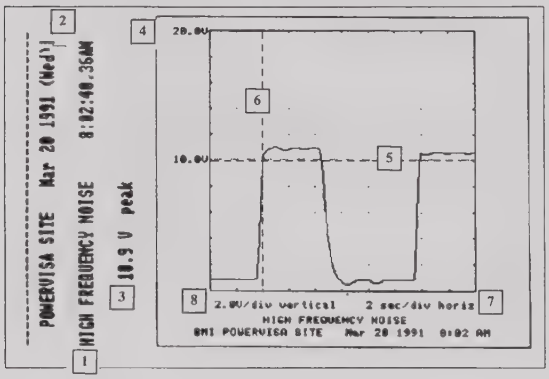
10 **Vertical scale.** Shown by tick marks along the left and right.

In some countries a neutral-to-ground bond is optional. If you are in one of these countries and the PowerVisa determines that neutral and ground are not bonded, the PowerVisa will not monitor (or report) neutral to ground.

11 Reading Graphs

High Frequency Noise Graphs:

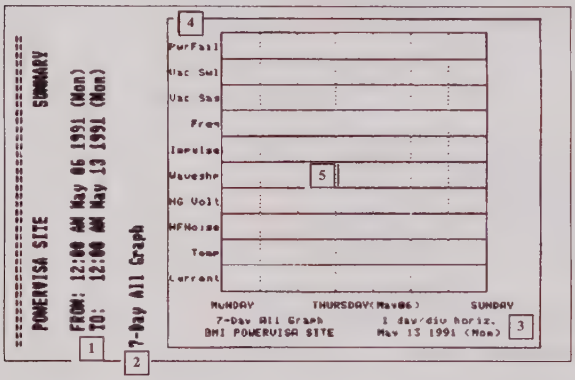
Arcing motors and radio transmitters are two sources of high-frequency noise, typically frequencies between 5 kHz-2MHz. The PowerVisa's high-frequency noise graphs are triggered when the signal crosses the threshold.



1. **Trigger.** This will say either HFN or HFN ENDED. If HF noise ends within 16 seconds, the entire disturbance is shown on a single graph.
2. **Date and time disturbance was recorded.**
3. **Maximum HFN voltage.**
4. **Vertical full-scale.** The value is fixed at 20.0 volts.
5. **HFN threshold line.**
6. **Trigger line.** The point in time when HFN exceeded the threshold.
7. **Horizontal scale.** Two seconds per division.
8. **Vertical scale.** Two volts per division.

ALL-graphs:

When the **Automatic Print LED** lights green, a 1-day ALL-graph and summary graphs print automatically at midnight. If the **Automatic Print LED** is off, you can see an ALL-graph by pressing the **Summary** button once. If the monitoring period has not passed midnight, a 24-hour ALL-graph will print. Whenever the monitoring period passes midnight (even if you began monitoring at 11 p.m.), a 7-day ALL-graph will print. If Automatic Print is on and you turn off summaries (see page 35), you will still get a 7-day ALL-graph on Sunday at midnight.



1 **Date and time data was recorded.**

2 **Type of ALL-graph.** 1-day or 7-day.

3 **Horizontal scale.** Either MIDNIGHT to MIDNIGHT (2 hours per division) or MONDAY to SUNDAY (24 hours per division).

4 **Type of disturbance.**

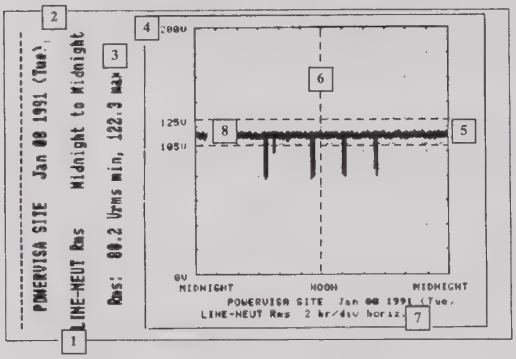
5 **Event marks.** Indicates when disturbances occurred.

In some countries a neutral-to-ground bond is optional. If you are in one of these countries and the PowerVisa determines that neutral and ground are not bonded, the PowerVisa will not monitor (or report) neutral to ground.

11 Reading Graphs

Summary Graphs:

Arcing motors and radio transmitters are two sources of high-frequency noise, typically frequencies between 5 kHz-2MHz. The PowerVisa's high-frequency noise graphs are triggered when the signal crosses the threshold.



1 **Type of Summary.**

2 **Date and time the Summary was printed.**

3 **Minimum and maximum values.**

4 **Vertical full-scale.** Automatically set depending on threshold setting.

5 **Threshold line(s).**

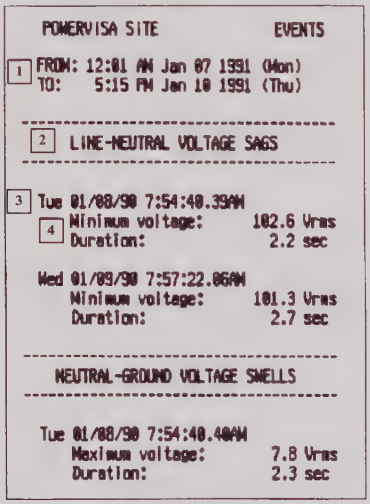
6 **Mid-point line.**

7 **Horizontal scale.** Two hours per division for 24 hour graphs; 1 day per division for 7-day graphs.

8 **Signal spread.** Generally, two black lines with shading in between, corresponding to the maximum and minimum values of the signal.

Summary graphs show present thresholds. If you changed thresholds during the monitoring period, the ALL-graph may show disturbances that do not cross thresholds on the summary graph. If your PowerVisa determines that neutral and ground are not bonded it will not print a neutral-to-ground summary

Events:
The Events printout is a list of disturbances stored in memory.


POWERVISA SITE EVENTS
1 FROM: 12:01 AM Jan 07 1991 (Mon)
TO: 5:15 PM Jan 10 1991 (Thu)
2 LINE-NEUTRAL VOLTAGE SAGS
3 Tue 01/08/90 7:54:40.39AM
4 Minimum voltage: 102.6 Vrms
Duration: 2.2 sec
Wed 01/09/90 7:57:22.06AM
Minimum voltage: 101.3 Vrms
Duration: 2.7 sec
NEUTRAL-GROUND VOLTAGE SWELLS
Tue 01/08/90 7:54:40.40AM
Maximum voltage: 7.8 Vrms
Duration: 2.3 sec

1 **Events monitoring time period.**

2 **Type of event(s).**

3 **Time event occurred.**

4 **Information specific to individual events.** For example, maximum or minimum voltage, duration, etc.

In some countries a neutral-to-ground bond is optional. If you are in one of these countries and the PowerVisa determines that neutral and ground are not bonded, the PowerVisa will not monitor (or report) neutral to ground.

Supplies and Options

12

Dranetz-BMI instruments use intelligent SmartProbes to measure additional parameters. SmartProbe current transformers have patented in-line descriptor modules that correct for errors in gain, phase response, and full-scale and offset readings. The following probes and cables are available for the 100G PowerVisa.

A-705	5 Amp Clamp-on CT* SmartProbe 3 kHz bandwidth; aperture size: 0.5" round
A-705T	5 Amp CT Interface SmartProbe 3 kHz bandwidth; aperture size: 0.375" window
A-721	20 Amp Clamp-on CT SmartProbe 3 kHz bandwidth; aperture size: 0.5" round
A-121	20 Amp CT SmartProbe Interface SmartProbe 3 kHz bandwidth; aperture size: 0.375" window
A-115	60 Amp Clamp-on CT SmartProbe 1 kHz bandwidth; aperture size: 0.5" round
A-115A	60 Amp Clamp-on CT SmartProbe 3 kHz bandwidth; increased phase accuracy; aperture size: 2.0" round
A-732	300 Amp Clamp-on CT SmartProbe 3 kHz bandwidth; aperture size: 2.0" round
A-116	600 Amp Clamp-on CT SmartProbe 3 kHz bandwidth; aperture size: 2.0" round
A-713	1000 Amp Clamp-on CT SmartProbe 3 kHz bandwidth; aperture size: 2.0" round
A-25E	SmartProbe Extension Cable Length: 25 ft. (7.7m)
A-017	Panel Probe Power cord, enables fused connection to disturbance panel (240 V max.)

* Current Transformer

12 Supplies and Options

G-401 Carrying Bag:

The PowerVisa carry bag stores and transports all the supplies needed for monitoring: PowerVisa, power cord, paper, User's Guide, and SmartProbe.

Material:	1100 Denier Nylon, waterproof, stain resistant
Length:	12 in (30 cm)
Width:	10 in (25 cm)
Depth:	(with outside pocket): 5.5 in (14 cm)

G-402 Rugged Carrying Case/Shipping Container:

The rugged shipping container safely protects your PowerVisa, A-115 SmartProbe, and paper.

Material:	ABS plastic
Length:	18 in (45.7 cm)
Width:	13 in (33 cm)
Depth:	5.75 in (14.6 cm)
Weight:	(empty): 4lb (1.8 kg)

Optional Power Cords:

Unless otherwise specified, Dranetz-BMI provides the power cord for the country in which the order originated. Order additional power cords by specifying the country.

S-401 Paper

PowerVisa paper ensures high-contrast printing so data can be photocopied.

Type:	Shear-cut thermal paper with Sheffield smoothness 10-50
Graphs/Roll:	approximately 200
Quantity:	12 rolls/case
Length:	75 ft (22.5 m)
Width:	2 in (6 cm)
Diameter:	1.7 in (4.3 cm)

Supplies and Options 12

To get the most out of your PowerVisa right away, order the Starter Kit that fits your needs.

S-404 Starter Kit

The S-404 Starter Kit includes a case of paper, carry bag, and Dranetz-BMI's ***Handbook of Power Signatures***.

S-405 Starter Kit

The S-405 Starter Kit adds an A-115 SmartProbe for measuring current to the S-404 Starter Kit.

S-440 Calibration Service

You can have your PowerVisa calibrated by Dranetz-BMI or you can do it yourself. Recommended calibration interval is 1 year. For field calibration instructions, press the **Help** button followed by the **Calibrate** button. See Chapter 13.

Calibration 13

Equipment Required:

- NIST traceable (if desired) power source with a single output voltage in the range of 90-290 Vrms, at 50 Hz or 60 Hz.
- Cable to connect the signal from the power source to the PowerVisa.

This calibration procedure should only be performed by qualified personnel. For calibration service, contact Dranetz-BMI Customer Service.

1. Connect the output of the power source to the input of the PowerVisa.
2. Set the power source to a voltage and frequency you will most likely be measuring. (For instance, in the U.S. you would set the power source to 120 Vrms, 60 Hz). Be careful not to exceed the power input specification for the PowerVisa.
3. Lift the PowerVisa's hinged cover to access additional buttons. Verify the month and year are correct by pressing the **Calibrate** button to print the present calibration report. If the month and year are correct, proceed to Step 5.

Before you can set the date you must clear the PowerVisa's memory by pressing the **Clear Panel/Clear Data** button twice. Before clearing the memory you may want to press the **Summary** button and the **Events** button to review the stored data.

4. To change the date, press the **Date** button to display a month/day format. Change the date using the **Value Up** and **Value Down** buttons. Press the **Date** button again to display the year and if necessary change it using the **Value Up** and **Value Down** buttons.
5. Press the **Calibrate** button twice to initiate the calibration procedure.
6. The letters "CAL" will briefly appear in the PowerVisa's display to let you know the calibration procedure has begun.

If you now choose not to perform the calibration procedure, press the **Monitor** button.

7. Use the **Value Up** and **Value Down** buttons to set the PowerVisa's display to the same voltage as the power source.

Once you lock in new calibration parameters "Calibrated by:" in the Calibration report will say "User" instead of "Dranetz-BMI".

8. Press the **Calibrate** button once more to lock in the calibration parameters.
9. In order to verify the new calibration, print a Calibration report by pressing the **Calibrate** button. The Calibration report should have a new month and year for "Date last calibrated:" and a new "Date Due:". The Line-Neutral, Neutral-Ground, and SmartProbe channel gain numbers should be about 1.000 ± 0.1.

Changing Paper 14

1. Lift the PowerVisa's hinged front cover and tilt it toward you.

2. If paper is still threaded through the printer mechanism, press the release lever, pull the paper free and lift out the old roll.

3. Drop a new roll of paper into the paper well. Position it so the paper unrolls from the bottom.

4. Press down on the release lever as you feed the paper through the printer mechanism.

5. Feed the paper through the slot in the front cover, close the cover, and pull on the paper until you feel it winding off the roll.

Theory of Operation 15

General Technical Description

The 100G PowerVisa monitors power continuously. It detects power disturbances such as voltage sags, swells, impulses, frequency deviations, waveshape faults and high-frequency noise. The PowerVisa combines two true RMS voltmeters, three digital oscilloscopes, two peak capture impulse detectors, a frequency counter, noise meter, temperature probe, and graphics printer into a notebook-sized package.

There are four major sections in the PowerVisa: the power supply and attenuator; the measurement circuitry, which performs data acquisition and reduction; the front panel keyboard, which serves as the user interface; and a high-speed, high-resolution graphics printer. In addition, the PowerVisa can also accommodate a current probe.

Fused Input

The PowerVisa's input is fused to protect the circuitry from over-voltage conditions which could damage the unit. Although the acceptable input voltage range is 90-290 Vrms, the unit can tolerate much larger voltages. For instance, the PowerVisa can accept IEEE 587 Type A impulses up to ±6000 Vpk without damage to the instrument. (The IEEE, Institute of Electrical and Electronic Engineers, defines a Type A impulse as a "0.5 microsecond, 100 Khz ring wave that rises from 10% to 90% in 0.5 microseconds, then decays while oscillating at 100 kHz, each peak being 60% of the preceding peak". See page 63.

The PowerVisa tolerates any IEEE 587 Type A impulse in excess of ±2000 Vpk and reports it as >2000 Vpk. It accurately measures any Type A impulses less than ±2000 Vpk.

The PowerVisa can also withstand IEEE 587 Type B impulses to ±6000 Vpk. A Type B impulse has much greater energy than Type A impulse. Although Type B impulses greater than ±1000 Vpk will blow the input fuse in a matter of milliseconds, for impulses between ±1000 Vpk and ±2000 Vpk, the PowerVisa will measure and store the disturbance data and safely shut down. A Type B impulse is defined as shown on page 63. (For more information on IEEE Standard 587-1980, see IEEE Guide for Surge Voltages in Low-Voltage AC Power Circuits).

Power Supply/Input Attenuator

This circuit serves two primary functions; it provides DC power to the internal circuitry and scales the input signals to acceptable voltage levels for measurement. The three input signals to the power supply/input attenuator circuit are line, neutral, and ground.

The line-and neutral input signals are split between the power supply and the attenuator. The attenuator is a resistor/capacitor network which divides the input signals 2048:3. This scales the line and neutral voltage signals to an appropriate level, in the range of ±3 volts, necessary for the rest of the PowerVisa's circuitry.

Differential amplifiers generate attenuated line-to-neutral, neutral-to-ground, and line-to-neutral voltages. These differential voltages are passed to the measurement board through a ribbon cable.

Unity Power Factor

The PowerVisa's power supply has a unity power factor. This unique design is needed because the input waveform and instrument power are derived from the same signal. Since the power input signal needs to be properly acquired and analyzed, it is imperative that the instrument power supply not alter the input signal in any way. In other words, unlike most electronic instrumentation available today, the PowerVisa's power supply introduces no harmonic distortion. The power supply has a special current sensor that adjusts the voltage duty cycle to the power supply in such a way that it draws the input current sinusoidally.

Measurement

The measurement circuitry digitizes analog signals for storage, data reduction, and analysis by the PowerVisa's main microprocessor. The measurement board also serves to communicate with the front panel keyboard and display circuitry. In addition, this board houses the printer and printer control circuitry.

The measurement board receives the attenuated line-to-neutral, neutral-to-ground, and line-to-ground signals from the power supply/input attenuator circuit. These input signals are filtered into high-frequency noise, impulse, and waveshape components.

Peak detectors retain the positive and negative maxima of impulses. The impulse phase position is calculated in software. Integration circuitry calculates impulse volt-seconds. The positive and negative peak detectors are reset every other cycle. A similar peak detection scheme, with different filter characteristics, is used to record high-frequency noise voltages.

The input from the optional SmartProbe comes directly to the measurement board. It is a current signal proportional to the current flowing through the conductor being monitored.

Other measured inputs to the measurement board include a temperature proportional voltage, and +24 volts from the power supply which indicates that external power is still being applied.

All of these input signals are multiplexed into a 12-bit analog-to-digital convertor. The direct memory access (DMA) controller, which is part of the main microprocessor, then loads this digitized data into one of two acquisition memory buffers. The acquisition buffers are alternated every cycle. Upon completion of the acquisition sequence, once a cycle, the data are parsed into six separate parameter memory buffers for later calculation by the main microprocessor.

The line-to-neutral and neutral-to-ground voltages and SmartProbe currents are digitally sampled at 5.12 kHz. Impulses, high-frequency noise, temperature and internal power are sampled once per cycle. Frequency is calculated by measuring time over sixteen zero crossings.

Waveshape Fault Detection
The PowerVisa's waveshape detection is a patented technique which compares the samples for each cycle to the corresponding samples in the previous cycle. If the samples differ by more than a user defined threshold value for one-tenth of a cycle, a waveshape fault is detected. This technique readily identifies subcycle drop-outs, addition or removal of substantial harmonic distortion, switching to or from a nonsinusoidal power source, and so on.

RMS Voltage and Current
The microprocessor calculates true RMS voltages and currents over 512 samples of data at a sampling rate of 5.12 kHz. The PowerVisa calculates true RMS regardless of the shape of the waveform by taking the square root of the mean of the sum of the squares of the data points.

Watts

True power in Watts is computed from the sum of each voltage data point multiplied by its corresponding current point and averaged over the calculation interval of 512 samples.

Power Factor

True power factor (PF) is the ratio of true power to apparent power. Apparent power is calculated by multiplying the RMS voltage by the RMS current. This gives correct results regardless of any distortion in the voltage and current waveforms. The PowerVisa calculates PF during harmonic analysis and uses 512 samples.

15 Theory of Operation

Harmonics

The PowerVisa performs harmonic analysis by the Fast Fourier (FFT) method using 1024 samples of data. The Harmonics report gives the percentage of total harmonic distortion for voltage and current (with optional SmartProbe) as well as Watts, Volts-Amps and Power Factor. Invoking the harmonics function takes the PowerVisa out of monitor mode. The PowerVisa will automatically resume monitoring after 5 seconds.

Wiring Error Detection

During power up the PowerVisa's measurement circuit looks at the line-to-neutral and neutral-to-ground signals to determine if line and neutral have been reversed or if ground is missing. If a wiring error exists, the PowerVisa lights the front panel **Wiring LED**. Special circuitry ensures the neutral-to-ground voltage will be looked at correctly even if line and neutral have been reversed.

Printer

The measurement board holds the printer and printer control circuitry. To ensure fast printing, the printer controller is handed parallel data via direct memory access. The reliable fixed head thermal printer gives high-speed, clear output. To maintain print quality be sure to use the recommended thermal paper.

Firmware

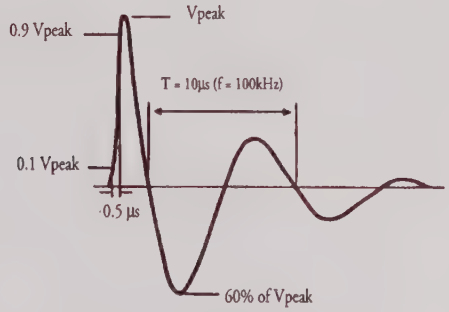
The PowerVisa's proprietary system software is written in "C", and where faster execution is needed, assembly language. The firmware is stored in four 128K EPROMs on the measurement board.

Front Panel Keyboard/Display

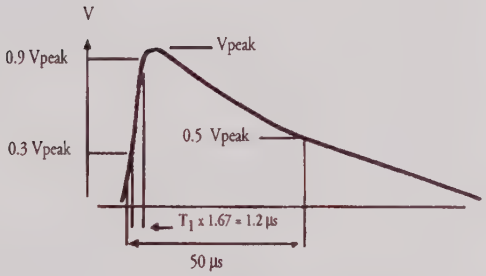
The front panel keyboard/display communicates with the measurement circuit via a 9600-baud RS-232 interface. The front panel circuit contains a microcontroller which sends and receives single character commands to and from the 16-bit main microprocessor.

SmartProbes

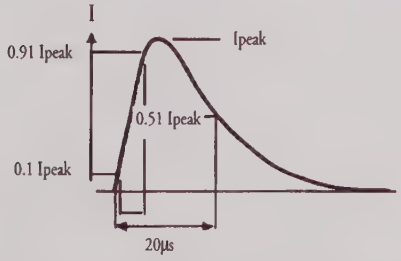
As an option, the PowerVisa uses a SmartProbe to measure current. The SmartProbe consists of a current transformer (CT) and a descriptor module. The descriptor module contains precise calibration data for the CT and provides a proportional current signal to the PowerVisa. This patented technique enables SmartProbes to measure current up to ten times more accurately than conventional current probes.



IEEE 587 Type A Impulse.



IEEE 587 Type B open circuit voltage waveform.



IEEE 587 Type B short circuit waveform.

Specifications 16

Operating Characteristics

Temperature range

Operation:	-4° F to +104° F (-20° C to +40° C)
Storage:	-40° F to +122° F (-40° C to +50° C)

Power In

Voltage Range:	100-240 Vrms
Frequency:	50/60 Hz
Power Consumption:	1.5 Arms at 120 Vrms

Battery Backup

Duration:	6 seconds
Time to fully recharge:	14 hours

Testing Approvals

FCC Class A

Physical Characteristics

Width:	8 in (20 cm)
Length:	11 in (28 cm)
Height:	2.5 in (6cm)
Weight:	5.5 lbs (2.5 kg)

Measurement Specifications

AC Voltage

L-N Input Range:	90-290 Vrms
N-G Input Range:	0-145 Vrms
Measurement Accuracy:	±0.2% full scale ±0.5% of reading (at 50/60Hz)

AC Frequency

Input Range:	45-65 Hz
Measurement Accuracy:	±0.1 Hz

16 Specifications

AC Current

Requires optional SmartProbe.

Input Ranges:	3-60 Arms 10.0-600 Arms
Measurement Accuracy:	±0.5% full scale ±0.5% of reading

Impulse Peak Voltage

Line to Neutral

For IEEE 587 Type A

Input Range Tolerated:	±6000 Vpk
Input Range Measured:	±2000 Vpk
Measurement Accuracy:	±5.0% of reading ±5.0% of full scale

Neutral to Ground

For IEEE 587 Type A

Input Range Tolerated:	±6000 Vpk
Input Range Measured:	±2000 Vpk
Measurement Accuracy:	±15.0% of reading ±5.0% of full scale

Power

Requires optional SmartProbe.

Input Range:	90 W to 174 kW
Measurement Accuracy:	±0.5% of full scale ±1% of reading

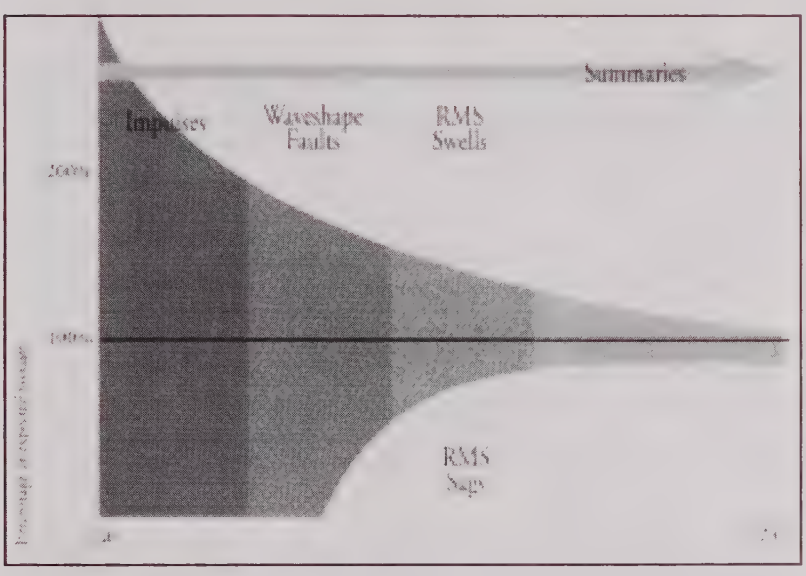
Volt Amps

Requires optional SmartProbe.

Input Range:	90 VA to 174 kVA
Measurement Accuracy:	±0.5% of full scale ±1% of reading

Temperature

Range:	0° C to + 40° C
Accuracy:	Not specified, intended as trend indicator only



This curve shows a typical safe operating envelope for electronic equipment. Harmful power disturbances fall outside this envelope and are defined in terms of voltage and duration.

Current

The flow of electricity in a circuit as expressed in amperes. Current refers to the rate at which electrical charge moves past a point. (Voltage is the measure of work it takes to move a charge through a circuit).

Frequency Variation

Change in the expected frequency. Frequency variations may occur during electrical storms, utility brownouts, during a large load change on a small generator, etc. If frequency variations are large, loads that rely on voltage zero crossings may be disrupted. These include phase-controlled loads such as adjustable speed drives which are used in motor controllers, disk drives, and many other types of equipment. In addition, extra zero crossings due to impulses, line notching, or harmonic distortion may result in similar problems.

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Ground, Safety
A conducting connection, whether intentional or accidental, by which an electrical circuit or equipment is connected to the earth, or to some conducting body of relatively large extent that serves in place of the earth. Often the green wire which provides a path for fault current to clear a protecting device.

Harmonic
A frequency that is a multiple of the fundamental frequency. For example, 120 Hz is the 2nd harmonic of 60 Hz, 180 Hz is the 3rd harmonic, and so forth.

Harmonic Distortion
Excessive distortion in the voltage or current waveform that introduces harmonic frequencies. Harmonic distortion can be caused by electronic loads drawing current in nonsinusoidal waveshapes. It can shorten equipment life and cause serious safety problems by overheating transformers and conductors.

High Frequency Noise
HF Noise is superimposed on the voltage waveform or on grounded and grounding conductors. Arcing motors and radio transmitters are two common sources of high-frequency noise. This disturbance can cause data disruption on low-level data lines (e.g. modems).

Impulse
Instantaneous voltage deviation which exceeds a programmed threshold. Impulses may not effect RMS voltage because of their short time duration, typically up to one millisecond. Impulses can be caused by loads switching on line, loose wires, lightning, static, and power failures. Impulses can cause data disruption and equipment malfunction and damage.

Line-to-Neutral Voltage
The potential difference between the phase conductor and the neutral conductor measured as either instantaneous volts (impulses) or RMS volts (sags, swells).

Load
Any electrical device connected to a power source.

Neutral Conductor
Sometimes called the return conductor. Provides a return path for current. May be common to more than one circuit and therefore can carry excessive current.

Neutral-to-Ground Voltage
The potential difference between the neutral conductor and ground measured as either instantaneous volts (impulses) or RMS volts (sags, swells).

Phase Position
The position in time, usually measured in degrees, relative to the positive-going zero-crossing of an AC sinusoidal signal of constant frequency.

Power Factor
Watts divided by volt-amps. This is true power factor. When harmonic distortion is present it will be different than the cosine of the displacement angle between voltage and current.

Power Failure
A long-term loss of voltage. The PowerVisa records a power loss when RMS voltage falls below the threshold of a power failure.

RMS Sag
Low RMS voltage or current excursions above the programmed threshold. Motor starts and faults on the utility system are two common causes of sags. Sags can cause loads to turn off and reset circuits to operate unexpectedly.

RMS Swell
High RMS voltage or current excursions above the programmed threshold. Swells can be caused by voltage regulation problems, removing loads from the system, or adding loads with stored energy. Swells can damage equipment or disrupt electronic loads.

RMS Voltage or Current
An effective average over time which is calculated by taking the digitally-sampled voltage or current and calculating the square root of the arithmetic mean of their squares.

Sine Wave
A fundamental waveform produced by periodic oscillation that expresses the sine or cosine of a linear function of time, or space, or both.

SmartProbes
Dranetz-BMI patented current probes have descriptor modules which store calibration information, allowing these devices to be 10 times more accurate than conventional current probes.

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THD (Total Harmonic Distortion)
Distortion of a sine wave. The PowerVisa reports THD as a percentage of the fundamental frequency voltage (and current if a SmartProbe is connected). Mathematically, it is the square root of the sum of the squares of the magnitude of voltage or current at harmonic frequencies divided by the fundamental expressed as a percentage.

Threshold
The point within which the measured parameter is said to be within tolerance.

Voltage
The force of electricity in a circuit as expressed in volts. It is the measure of work it takes to move a charge through a circuit.

Volt-Amps
True RMS voltage multiplied by true RMS current.

Volt-Second
Unit of measure that quantifies volts over time. It is used as a measure of the strength of an impulse. The unit volt-second converts directly to joule/amp so if amps are known, the energy in joules can be determined.

Watts
The active power consumed in the circuit resulting in heat or real work performed. The mean value of the product of instantaneous volts and amps.

Waveshape Faults
A momentary waveshape distortion. A waveshape fault may not be large or fast enough to have impulse characteristics, and at the same time, may not add or subtract significantly from the voltage to create a sag or swell. Waveshape faults can be caused by loose wiring, switching between two power sources, etc. Waveshape faults can cause damage and disruption to all types of loads.

Wiring Error
The PowerVisa reports a wiring error when the phase and neutral conductors are reversed, no neutral-to-ground bond exists, or ground is missing. These conditions may present a safety hazard and cause data disruption or damage to sensitive electronic equipment.

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